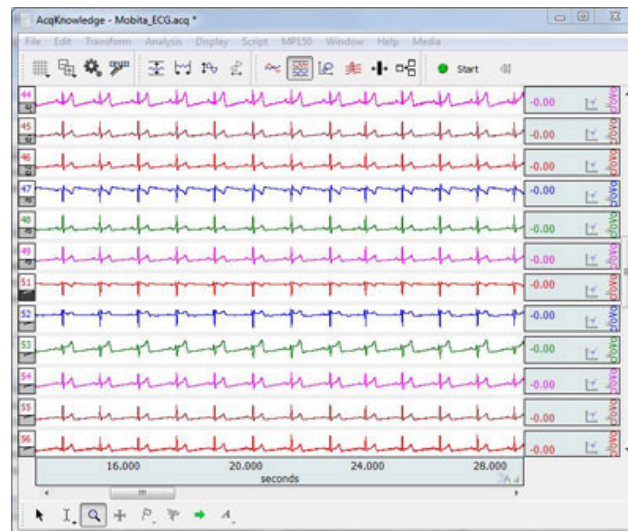


Mobita[®] User Manual

Wearable Biopotential System

For Life Science Research Applications



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About This Manual

General

This manual contains the information needed to

- install
- operate
- maintain

the Mobita system. In this manual the Mobita system is referred to as “the hardware.”

The hardware is designed to be used with a computer running Windows 7 OS or greater. Refer to the Mobita Installation Guide for detailed information on system requirements for the computer.

How To Use This Manual

- Read this manual carefully before installing and using the hardware.
- Complete the actions in the given sequence.
- Keep a copy of this manual near the hardware.












Safety

User Qualification


The user must have knowledge of current good practice in physiological measurement for life science research. In general, the hardware is intended for use by a life science researcher.

Explanation of Icons


In this manual or on a device label you may find one or more symbols. Their meaning is as follows:

Symbol	Description
	Consult instructions for use.
	Device has type CF applied parts.
	Device is Class II hardware.
	Special EU instructions for disposal are applicable to a product on which this symbol is placed. The Maintenance section of this manual contains information on how to dispose of this hardware.
	Identification of the manufacturer.
	This device includes an RF transmitter.
	This device meets applicable EU requirements, refer to "Declaration of Conformity."
	Electrostatic sensitive part: do not touch.
	Manual contains important safety information.
	Direct current.
	USB component.

Limitations of Use

Warning	
	<p>The hardware is NOT intended for critical subject monitoring</p>
<ul style="list-style-type: none"> • Hardware is not to be used near MRI hardware. • Hardware is not to be exposed to ionizing radiation. • Hardware is not to be used on subjects undergoing electro surgery or defibrillation. • Hardware is not to be used in the presence of anesthetic agents or gases. • Hardware is not to be used in oxygen rich environments (concentration > 25% at 1 atm). • Apart from the above, there are no contra-indications. 	

Safety Measures

Warning	
	<p>The only mains power adapter that may be used is the original adapter, type FW7650/05, included with the hardware. DO NOT replace it with anything else. If any other type of mains power supply is used neither safety nor correct operation of the hardware can be guaranteed.</p>
<ul style="list-style-type: none"> • Make sure the computer is installed according to local regulations and safety precautions. • If the computer is equipped with a safety earth conductor, use it only if connected to a well earthed wall socket. • Do not connect active sensors or electrodes to any of the inputs unless they have been approved by BIOPAC. • Do not modify the hardware. • The subject must not touch the docking station. • Do not place the docking station, USB cable, mains power adapter or computer in subject environment, i.e. within typically two meters from the subject. • The hardware requires a computer that has an appropriate protection against electrical shock. The docking station is an IEC protection Class I appliance when it is connected to this computer via the USB cable. When connected to an IEC Class II protected computer, the docking station is a Class II appliance. The docking station is a Class II appliance when it only connects to the mains power adapter. 	

Precautionary Measures

Warning

- The Mobita main unit should not come into prolonged contact with mucous membranes, body liquids or roughened skin.
- Avoid placing Mobita near mobile phones or other sources of electromagnetic emissions, as this may influence the quality of the acquisition data.

Warnings

Warning



- **BIOPAC cannot guarantee safety and performance of the system when used in conjunction with non - BIOPAC supplied accessories.**
- **The system is not defibrillator proof.**
- **This system is not suitable for use in an inflammable mixture of anesthetics and air, oxygen or nitrous oxide.**
- **Do not immerse the system in any liquid.**
- **If liquids or moisture penetrate any part of the system disconnect the affected part from all other system parts. If in doubt about safety or performance of the system, have the system checked by the manufacturer.**
- **Do not expose the system to direct sunlight, heat from a source of thermal radiation, excessive amount of dust, moisture, vibration, or mechanical shock.**
- **Do not wind the cables in a loop smaller than 5 cm or bend them sharply, this may damage the cables.**
- **Do not touch the inside of the connector of the Mobita main unit.**
- **In case of obvious damage to any part of the hardware, immediately disconnect from the subject and/or do not use.**
- **Do not incinerate any of the system parts.**
- **The reliability of the wireless connection (WLAN) is not guaranteed and depends on environmental influences.**

Mobita System Components

Compare your purchase with Figure 1 to verify whether all Mobita system components are present.

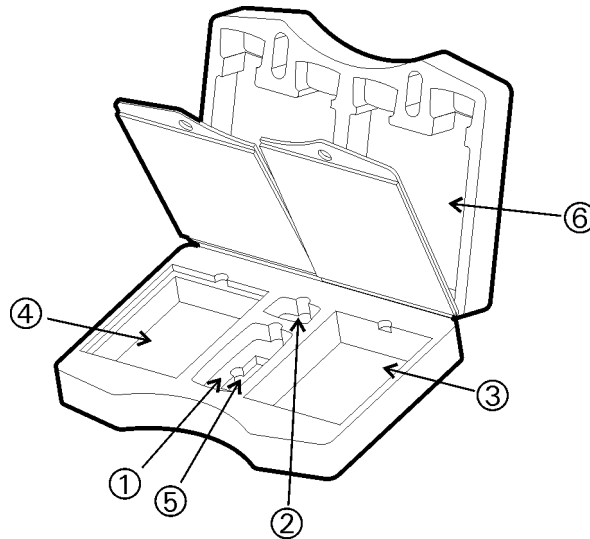


Figure 1. Location of Mobita system components

Description	
1	Mobita main unit and protective cover
2	Docking station
3	Mains power adapter
4	Installation CDs, documentation, USB cable
5	WLAN USB adapter
6	ConfiCap

NOTE:

Actual items may differ from this typical scope of delivery. Check package list for actual package contents. **In case of unexpected package contents, contact BIOPAC support.**

Mobita Main Unit

Contains electronics for acquisition, data storage and transmission. A cover protects the inside connector (see 5 in Figure 2) of the Mobita main unit when no docking station or ConfiCap is connected.

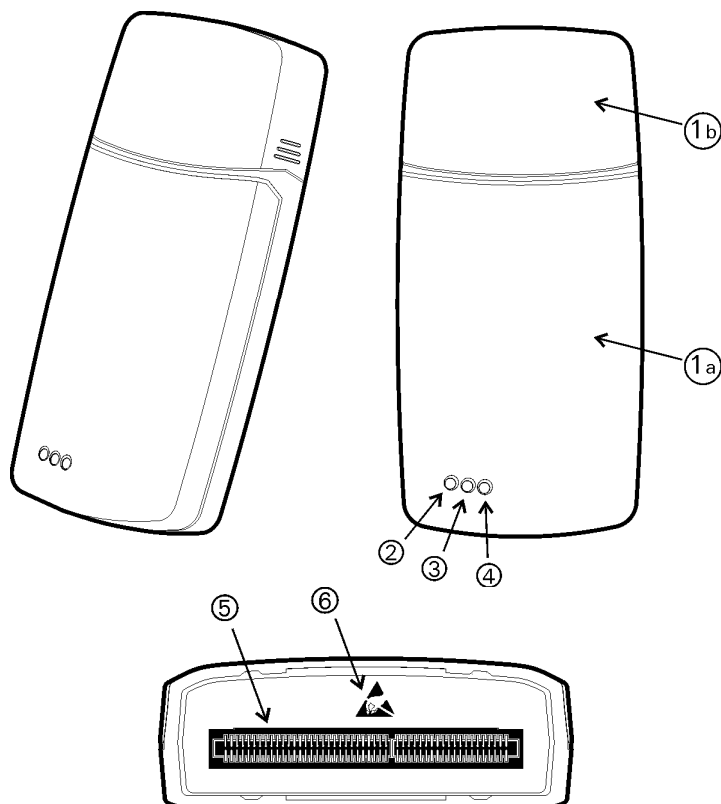


Figure 2. Mobita main unit and protective cover

Description	
1a	Mobita main unit
1b	Protective Cover
2	Green indicator light
3	Blue indicator light
4	Orange indicator light
5	Connector for ConfiCap and docking station
6	Warning symbol: 'Do not touch!'

Figure 2 shows three colored indicator lights. Chapters 5 and 6 discuss the meaning of these indicator lights. Refer to appendix A for an overview.

Docking Station

The docking station is intended for charging the Mobita main unit battery and establishing a USB connection to a computer to export ambulatory acquisition data. See Figure 3 for a picture of the docking station.

NOTE:

Do not store Mobita with docking station attached; this will (slowly) drain the battery. Use the protective cover instead.

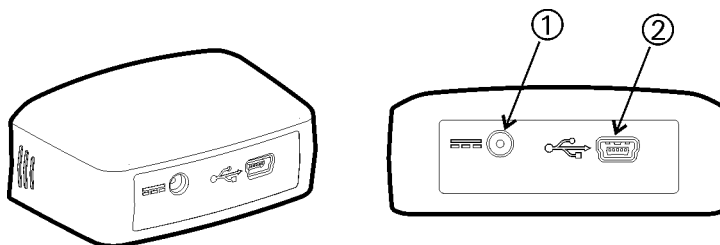


Figure 3. Docking station details

Description	
1	Connector for mains power adapter
2	Connector for USB cable

ConfiCap

The ConfiCap easily connects electrodes and sensors and activates the Mobita main unit.

Refer to the corresponding ConfiCap manual for specifications. Figure 4 shows a ConfiCap example. Actual ConfiCap may differ from this example.

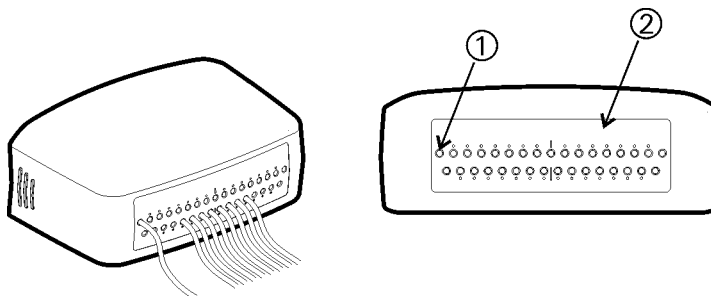


Figure 4. ConfiCap details

Description	
1	Subject ground electrode lead
2	Signal leads

Mains Power Adapter

Provides power to the docking station. Type FW7650/05, see Figure 5 and label on the adapter for details.

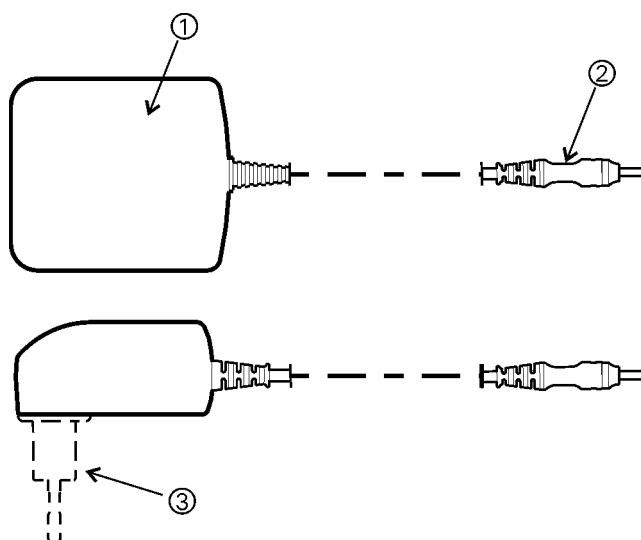


Figure 5. Mains power adapter details

Description	
1	Mains power supply
2	Charging lead and connector
3	Exchangeable mains power plug: Europe, UK, USA/Japan.

WLAN USB Adapter

For wireless communication with the computer a WLAN USB adapter) is used as reflected in Figure 6.

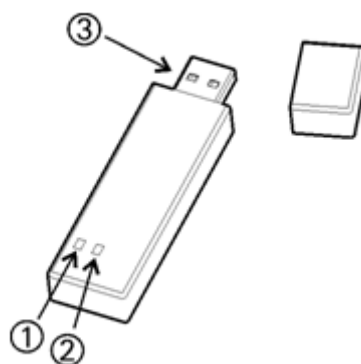


Figure 6. WLAN USB adapter

Description	
1	Connection indicator light
2	Power indicator light
3	USB connector

USB Cable

For connecting docking station and computer.

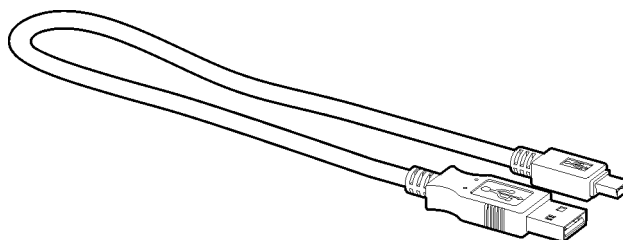


Figure 7. USB 2.0 cable

NOTE:

Use only a USB 2.0 cable for replacement.

Device Labels

For identification of Mobita system parts.

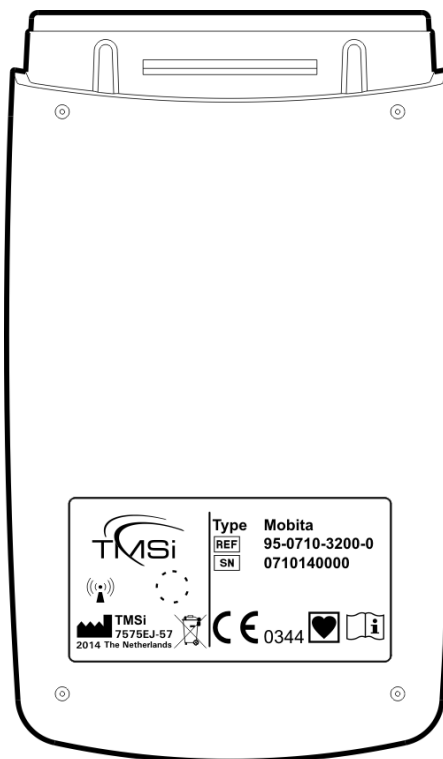


Figure 8. Example of device label

Description	
Type	Type identification
SN	Serial number
Power	Power requirements
REF	TMSi product code

Hardware Description

Intended Use

The Mobita system is intended to

- acquire high quality bio-electrical and other physiological signals
- transfer these signals to a computer for processing and analysis.

The system is designed for measuring a wide range of physiological signals. These signals include EEG, EMG, ECG, EOG, EGG, and accelerometer signals that describe body movement.

The system is intended for use on humans.

The system is intended for use in a laboratory or home environment.

Only use the equipment with the supplied accessories. In case other parts or accessories are required, contact BIOPAC support for information.

System Description

The Mobita system is a general purpose signal system for acquiring high-quality physiological data. Users need a computer running Windows 7 or higher and *AcqKnowledge* software for data acquisition and analysis.

The Mobita main unit (Mobita) contains the electronics for amplification, digitization, storage, wireless transmission and power supply. Sensors and electrodes simultaneously connect to the Mobita through the ConfiCap. During acquisitions the Mobita runs on its on-board battery. When the Mobita has stored data in its on-board memory, the computer fetches this data from memory over the USB connection.

The user can interact with the Mobita from the computer over a wireless (WLAN) connection. This requires installation of the WLAN adapter on the USB port of the computer. (See Mobita Installation Guide for details.)

Principles of Operation

The Mobita contains a true DC reference amplifier with very low input noise, very high input impedance and very high common mode rejection. Active guarding minimizes electrode cable capacitance.

Use of special electrode leads controls movement artifacts. The amplifier is very insensitive to 50/60Hz mains power interference. The Mobita digitizes signals from the ConfiCap at various sample rates.

The Mobita runs on a rechargeable lithium-polymer battery. It can store data for several hours on its internal memory card or transmit real time data to the computer by means of a WLAN connection.

AcqKnowledge software installed on the computer controls the Mobita data acquisition and analysis functions. (See the Mobita chapter of the *AcqKnowledge* Software Guide for details on Mobita software functionality.)

For more detailed technical information about the operating principles of the equipment, contact BIOPAC support.

Installation Overview

General Installation

Install the Mobita system according to the following steps.

Installation steps	
1	Install AcqKnowledge software and TMSi driver to computer. Refer to Mobita Installation Guide for detailed instructions.
2	When prompted, connect USB cable to docking station and computer.
3	Connect the WLAN USB adapter to the computer.
4	Follow the Mobita Network Configuration Utility installation prompts to prepare the wireless ad-hoc network between Mobita and the computer.
5	Installation is completed. Mobita is ready for data acquisition. Remove Mobita from docking station and connect the ConfiCap to establish connection via WLAN.
6	Place protective cover on Mobita for safe storage.

NOTE:

The installation procedure requires Windows administrator rights.

Operation

For data acquisition, use the equipment as described below.

Prerequisites

1. Make sure that *AcqKnowledge* software is installed on the computer according to the Mobita Installation Guide.
2. Refer to the *AcqKnowledge* Software Guide and Mobita Installation Guide for information.

Check Mobita Status

1. Make sure that mains power adapter is connected to wall socket.
2. Make sure docking station is connected to mains power adapter.
3. Make sure docking station is connected with USB cable to computer.
4. Make sure that WLAN adapter is connected to USB port.
5. Make sure computer is switched on.
6. Connect Mobita to docking station.
7. Identify battery status from orange light as described in Appendix A.
8. Identify USB connection status from blue light as described in table below.
9. If orange and blue lights do not blink, proceed to “Acquisition using WLAN” or “Ambulatory Acquisition.”

Data Acquisition using WLAN

The Mobita is able to transmit signal data over a wireless local area network (WLAN) to the computer.

1. Place ConfiCap electrodes and/or sensors on subject.
2. Remove Mobita from docking station - do not touch metal parts on Mobita connector near warning symbol.
3. Connect Mobita to ConfiCap.
4. Verify that blue light is blinking six times per second, indicating that Mobita is searching for a wireless connection
5. If connection is made, blue light is continuously ‘on’. This can be verified in the network connection status on the PC.
6. Verify that orange light on Mobita is continuously “off.”
7. Click the “Start” button in *AcqKnowledge* software acquisition and verify that green light on Mobita is blinking once per two seconds (indicating that data capture is in progress).
8. To finish data capturing, click “Stop” in *AcqKnowledge* software or disconnect ConfiCap from Mobita. Take care to not touch metal parts on Mobita connector near the warning symbol.

NOTE:

After disconnecting a ConfiCap or docking station from the Mobita, always wait until all indicator lights are off before reconnecting.

For a detailed explanation of all indicator lights, refer to Appendix A of this manual.

Ambulatory Acquisition

1. Connect Mobita to docking station.
2. Wait until blue light on Mobita is continuously “on.”
3. To configure Mobita for ambulatory acquisition (logging mode); set the *AcqKnowledge* software’s acquisition mode to “Save Once (Wifi + Logging).”
4. Prepare the subject for the acquisition. Connect electrodes and sensors of the ConfiCap to the subject.
5. After configuring the Mobita, disconnect the docking station and connect the ConfiCap to Mobita. (You may be prompted to do this after clicking the “Start” button in *AcqKnowledge* software.) Take care to not touch metal parts on Mobita connector near the warning symbol.
6. Depending on the settings of your configuration, the acquisition will start immediately or on the specified start time.

Exporting Ambulatory Acquisitions

7. Remove Mobita from ConfiCap as prompted.
8. Connect Mobita to docking station as prompted.
9. Wait until blue light on Mobita is continuously “on.”
10. Use *AcqKnowledge* software to export signal data from Mobita - refer to *AcqKnowledge* Software Guide.
11. Verify that blue light on Mobita is blinking once per two seconds indicating that data transfer is in progress.
12. Verify that blue light on Mobita has stopped blinking indicating that data transfer is finished.
13. Leave Mobita connected to docking station for charging.
14. Charge until orange light on Mobita is continuously “off.”
15. Remove Mobita from docking station – take care to not touch metal parts on Mobita connector near warning symbol.
16. Place protective cover on Mobita.
17. Remove mains power adapter from wall socket.
18. Store equipment in a safe place.


NOTE:

After disconnecting a ConfiCap or docking station from the Mobita, always wait until all indicator lights are off before reconnecting.

For a detailed explanation of all indicator lights, refer to Appendix A of this manual.

Maintenance

Equipment does not contain user serviceable parts. Maintenance is limited to regular cleaning. Repairs can only be performed by the manufacturer. Equipment does not require calibration.

Cleaning	
	<ul style="list-style-type: none"> Before cleaning, make sure equipment is turned off and not in contact with a subject.
	<ul style="list-style-type: none"> Use a slightly damp cloth for cleaning.
	<ul style="list-style-type: none"> Never use aggressive chemicals for cleaning.
	<ul style="list-style-type: none"> Only use water, methylated spirit or isopropyl alcohol for cleaning.
	<ul style="list-style-type: none"> Do not sterilize equipment.
Charging batteries	
	<ul style="list-style-type: none"> Make sure that battery is sufficiently charged before acquisition to avoid incomplete acquisitions.
	<ul style="list-style-type: none"> The Mobita has built-in protection circuits to prevent battery overcharging or exhaustion.
	<ul style="list-style-type: none"> Try to avoid frequent full discharges. Instead, charge battery as soon as possible.
	<ul style="list-style-type: none"> For a realistic indication of remaining battery service life, it is necessary to fully discharge (use up) the battery and then fully recharge it again. Limit this to no more than once every 30 usage cycles.
	<ul style="list-style-type: none"> Store the Mobita with fully charged battery when it will not be used for a longer time.
Maintenance of accessories	
	For maintenance and cleaning of an accessory, refer to the corresponding user manual.
Environmental protection	
	Special EU instructions for disposal are applicable to a product on which this symbol is placed. These instructions apply to all parts of the equipment.

The above symbol means that the products must not be disposed of with other waste. Instead, it is the user's responsibility to dispose of their waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can dispose your waste equipment for recycling, please contact your local city office, your household waste disposal service, or BIOPAC.

Technical Specifications

Mobita Main Unit

Regulatory	
CE	CE-certified, see declaration of conformity.
Safety class	Internally powered, type CF
Power supplies	
Internal power supply	Li-polymer with protection circuit, capacity 4100 mAh
Docking station	Refer to the docking station specifications
Inputs	
Input signal difference	409.6 mVpp
Input common mode range	-2.0 V – +2.0 V
Gain factor	10
Noise	< 0.4 μ V RMS @ 0.1 – 10 Hz
Input impedance	> 10 G Ω
CMRR	> 100 dB (typical)
AD Conversion	
Resolution	24.414 nV/bit, referred to input
Sample frequency	2000 Hz, 1000 Hz, 500 Hz, 250 Hz.
Channel bandwidth	DC up to 0.2 * sample frequency
Filtering	
No filtering within channel bandwidth. Digital IIR filtering for various signal types is controlled by AcqKnowledge software.	
3D accelerometer	
Range	$\pm 16 g$
Resolution	13 bit
Sensitivity	3.9 mg/bit
Wireless telemetry	
RF transmitter	WLAN IEEE 802.11b/g
Radiated power	9 dBm (8 mW)
Mode	Ad-hoc
Protocol	TCP/IP
Encryption	WEP
Range	typical > 10 m (indoors)
Internal storage	
Flash disk	up to 16 GB
Dimensions	
External dimensions	150 x 70 x 25 mm (L x W x H) with ConfiCap attached

ConfiCap

For a description of the ConfiCap properties, refer to the ConfiCap manual(s) delivered with your system.

Docking Station and Mains Power Adapter

Power supply	
USB	Max. 500 mA
Power mains voltage	AC 100–240 V, 50/60 Hz
Mains power adapter	Power consumption: 150 mA Output: DC 5 V, 1000 mA
Safety class	Class II
Applied standards	See declaration of conformity

WLAN USB Adapter

Wireless telemetry	
RF transmitter	WLAN IEEE 802.11b/g
Applied standards	See declaration of conformity

General

Environment	
Usage temperature	0°C – +40° C (recommended)
Storage temperature	+10°C – +30°C
Transport temperature	-10°C – +45°C
Humidity(non-condensing)	10% – 90%
Pressure	500 hPa – 1060 hPa
Applied parts	
The equipment has cardiac floating (CF) applied parts. These parts are the electrodes, sensors and their cables that are connected to the ConfiCap.	

Electromagnetic Guidance

Guidance on electromagnetic emissions

The Mobita system is intended for use in the electromagnetic environment specified below. The customer or the user of the Mobita system should assure that it is used in such an environment.

Emission test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The Mobita system uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The Mobita system is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/flicker emissions IEC 61000-3-3	Complies	

Guidance on electromagnetic immunity

The Mobita system is intended for use in the electromagnetic environment specified below. The customer or the user of the Mobita system should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	± 6kV contact ± 8kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV line(s) to line(s) ±2 kV line(s) to earth	±1 kV line(s) to line(s) ±2 kV line(s) to earth	Mains power quality should be that of a typical commercial or hospital environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<p><5 % UT (>95 % dip in UT) for 0,5 cycle: 40 % UT (60 % dip in UT) for 5 cycles: 70 % UT (30 % dip in UT) for 25 cycles: <5 % UT (>95 % dip in UT) for 5 s</p>	<p><5 % UT (>95 % dip in UT) for 0,5 cycle: 40 % UT (60 % dip in UT) for 5 cycles: 70 % UT (30 % dip in UT) for 25 cycles: <5 % UT (>95 % dip in UT) for 5 s</p>	<p>Mains power quality should be that of a typical commercial or hospital environment.</p> <p>If the user of the Mobita system requires continued operation during power mains interruptions, it is recommended that the Mobita system be powered from an uninterruptible power supply or a battery.</p>
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE: UT is the AC mains voltage prior to application of the test level.			

Appendix A

Indicator Light Functions

Table 1: Describes indicator light behavior when the Mobita hardware is connected to the docking station.

Table 2: Describes indicator light behavior when the Mobita hardware is connected to a ConfiCap.

Table 1: Mobita connected to docking station

Color	Action				
	Off	On	Slow blinking	Medium blinking	Fast blinking
ORANGE	Battery full	Charging battery	--	Charging error	Defective battery
GREEN	--	Time acquisition configured (after 2 seconds: light switches off)	--	--	--
BLUE	Not connected	Connected	Transferring data	--	Searching for connection
Medium blinking simultaneously					
ALL	Docking station error				

Table 2: Mobita connected to ConfiCap

Color	Action				
	Off	On	Slow blinking	Medium blinking	Fast blinking
ORANGE	Operation OK	--	Battery low	--	--
GREEN	Not acquiring	Time acquisition configured (after 2 seconds: light switches off)	Acquiring data	--	Storage memory full
BLUE	Not connected	Connected	Transferring data/downloading logged data	--	Seraching for connection
Medium blinking simultaneously					
ALL	ConfiCap error				
Blinking sequentially					
All	Timed acquisition setting is incompatible with the attached ConfiCap				
Slow blinking simultaneously					
GREEN/BLUE	Acquiring data in WiFi mode only				
Slow blinking sequentially					
GREEN/BLUE	Acquiring data in WiFi+Logging mode				

Intended Use

BIOPAC Systems, Inc., instruments, components, and accessories are designed for educational- and research-oriented life science applications and investigations. BIOPAC Systems, Inc. does not condone the use of its instruments for clinical medical applications. Instruments, components, and accessories provided by BIOPAC Systems, Inc., are not intended for the diagnosis, cure, mitigation, treatment, or prevention of disease.

Warranty

BIOPAC Systems, Inc. warrants to the original end purchaser that

- the Mobita[®] hardware shall be free from material defects in material and workmanship for a period of one (1) year from the original date of purchase (the "Hardware Warranty Period")
- the software shall be free from material defects or errors for a period of one (1) year from the original date of purchase (the "Software warranty period").

If the product is determined to be materially defective during the Warranty Period, your sole remedy and BIOPAC's sole and exclusive liability shall be limited to the repair or replacement of this product with a new or refurbished product at BIOPAC's or its licensed distributor's option. For purpose of this Limited Hardware Warranty and Liability, "refurbished" means a product that has been returned to its original specifications. Visit WWW.BIOPAC.COM for instructions on how to deliver the product to an authorized service facility.

This warranty shall not apply if this product

- a) is used with products that are not compatible with this product
- b) is modified, or tampered with
- c) is damaged by acts of God, misuse, abuse, negligence, accident, wear and tear, unreasonable use, or by other causes unrelated to defective materials or workmanship
- d) has had the serial number altered, defaced or removed
- e) has, in the reasonable opinion of BIOPAC or its licensed distributors, been opened, altered, or defaced.

This warranty shall also be voidable by BIOPAC or its licensed distributors

If (1) BIOPAC reasonably believes that the Mobita[®] system has been used in a manner that would violate the terms and conditions of a separate end user license agreement for system software; or (2) the product is used with products not sold or licensed by BIOPAC. You assume all risks and liabilities associated with use of third party products.

This warranty is provided to you in lieu of all other express or implied warranties including warranties of merchantability and fitness for a particular purpose for the Mobita[®] system, which are disclaimed hereunder. However, if such warranties are required as a matter of law, then they are limited in duration to the warranty period.

Our sole and exclusive recourse in the event of any dissatisfaction with or damage arising from the use of the Mobita[®] system and BIOPAC's maximum liability shall be limited to repair or replacement of the Mobita[®] system. Except as expressly stated above, BIOPAC excludes all liability for any loss of data, loss of profit, or any other loss or damage suffered by you or any third party, whether such damages are direct, indirect, consequential, special, or incidental and however arising under any theory of law, as a result of using your Mobita[®] system. Some countries, states or provinces do not allow limitation on how long an implied warranty lasts and some countries, states and provinces do not allow the exclusion or limitations of consequential or incidental damages, so the limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from country to country, state to state or province to province. This warranty is in all countries where BIOPAC has an office or a licensed distributor. The warranty offered by BIOPAC Systems, Inc. on your Mobita[®] hardware is the same whether or not you register your product.

Mobita[®] is a trademark of TMSi (Twente Medical Systems International B.V.)